

# **ATTACHMENT C**

Exhibit B

Concept Paper, Thomas Lippert, V0.1, 19.6.2010, confidential

Proposal for a Research and Development Project

## **Dynamical Exa-Computing (DECO)**

Exa-Boosters for Cluster Computers

### **Background**

#### **ICT-2011.9.13**

The FP7 ICT call 7 will present the “Objective ICT-2011.9.13 Exascale computing, software and simulation”. This is the first objective in FP7 dedicated to Exascale technology. It will be supported through probably three integrated projects (IP) with a volume of M€ 8 each.

The goal is to develop a small number of supercomputer platforms with the potential of 100 PF in 2014 and prospects for Exascale in 2020.

This should go along with the development of application codes optimized to these platforms reflecting the needs of computational science and engineering and today’s grand challenges.

Proposals should address extreme parallelism with millions of cores and should involve algorithms, programming models, compilers, power consumption, etc.

Each IP should comprise one or more SC centres, technology and system suppliers including vendors, industrial or academic centres to co-develop a small number of Exa-scaled application codes. 40 % application software, 60 % system development.

Proposals may include international cooperation components. All software should be developed as open source. EC officers have confirmed that there can be a US company involved and that a few SMEs from one country might contribute. The IP should involve at least three of more countries from Europe.

Date of publication, 28.9.2010, Deadline, 18.1.2011.

#### **New Intel Many Core Processors (Knights Ferry, Knights Corner)**

The recent announcement of Intel to produce a many-core-line of processors starting with the Knights Ferry processor and developing the Knights Corner processor until 2012 opens a new era of co-processing for cluster computers. In particular, Intel will provide a continuation of the X86 programming model that will allow for a continuous migration to many core computing in contrast to GPU based accelerator models.

#### **Hybrid Computing – Towards Parallel Co-Processing**

It is by now well understood that fine-grained (local) hybrid computing shows shortcomings and does not provide a scalable model reaching out to Exascale for most of the relevant applications.

In contrast to traditional hybrid computing, a careful analysis of application codes shows that a coarse-grained architectural model, where the highly scalable parts of an application code are executed on a parallel many-core architecture, which is accessed dynamically, can provide Exascale capability for quite a number of applications with Exascale needs. In this concept paper, the development of a cluster computer with parallelized many-core co-processing satellites is proposed as a model going towards the Exascale.

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<b>Architecture</b>	aaaa
<b>Technology</b>	cccc 10 mal QPACE...Many core
<b>Project</b>	Steps: start with 64 Knights Ferry System and EXTOLL communication Continue with stand-alone system Knights Corner Develop dynamical allocation
<b>Consortium</b>	bbbb
<b>Outreach</b>	SFB TR Hadron Physics